

REMARKS

This application is believed to be in condition for allowance.

Status of the Claims

Claims 1 and 13 are amended. Support for the amendment to claim 1 may be found, for example, in paragraphs 13-15 and 22-24.

Claims 1-3 and 6-43 remain pending.

Claim Objections

Claim 1 was objected to for reciting "the amount of tungsten" without providing sufficient antecedent basis.

The Official Action appeared to object to claim 1 because "tetrahedral" is used to characterize an atom. However, this is a misunderstanding of the present invention, as it should be understood that tungsten has a tetrahedral coordination relative to the support.

Accordingly, the claim has been amended to clarify the amount and coordination form in the claim in a manner consistent with paragraphs 13-15 and 22-24.

Withdrawal of the objection is respectfully requested.

Claim Rejections-35 USC §103

Claims 1, 2, 6-8, 28-30, 42 and 43 were rejected under 35 U.S.C. §103(a) as being unpatentable over VAUDAGNA et al. Applied Catalysis, 1997 ("VAUDAGNA"). This rejection is respectfully traversed for the reasons below.

VAUDAGNA was offered for teaching a tungsten oxide supported on Zirconia, obtained by impregnation of a zirconia dioxide with a tungstic acid solution, which exhibits 62-69% tetragonal phase. The Official Action considered that the tungsten catalyst disclosed by VAUDAGNA is substantially the same product as claimed in the present invention, and that the process utilized to obtain the product should be give little patentable weight.

In support of this position, the Official Action noted that VAUDAGNA observed that the nature of tungsten species on $\text{WO}_x\text{-Al}_2\text{O}_3$ depends on the amount of WO_3 . That is, for concentrations below 15%, a tetrahedrally coordinated species of the WO_4^{2-} type is present, and for concentrations between 15% and 24% an octahedric polymeric WO_3 species is present in addition to the tetrahedric species. At concentrations above 24% WO_3 , bulk WO_3 crystallites are formed.

The Official Action concluded that one of ordinary skill in the art would have recognized a tungsten species,

deposited on a similar oxide support at 20% would have contained both tetrahedral and octahedral structures.

However, VAUDAGNA fails to render obvious the claimed invention, as VAUDAGNA teaches away from the claimed solid features and VAUDAGNA utilizes a method that produces a different solid, as explained below:

I. VAUDAGNA teaches away from the claimed solid.

The solid described in independent claim 1 comprises 10% to 25% tungsten has tetrahedric coordination.

VAUDAGNA, however, discloses that with more than 15% WO₃ on the support the obtained catalyst will comprise tungsten in both tetrahedric and octahedric forms. VAUDAGNA requires at least 15% WO₃ based on the fact that with less than 15% WO₃ on the alumina support, tungsten has a tetrahedric coordination.

Thus, VAUDAGNA would have deterred one of ordinary skill in the art from trying to obtain a solid comprising a single layer of tungsten oxide on a support of zirconia and/or titanium wherein for more than 15% to 25% of the tungsten has tetrahedric coordination.

II. The method of VAUDAGNA produces a different solid.

The solid described in independent claim 1 comprises 10% to 25% tungsten has tetrahedric coordination, whereas VAUDAGNA discloses that with more than 15% WO₃ on the support

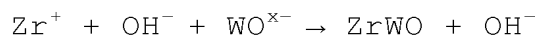
the obtained catalyst will comprise tungsten in both tetrahedric and octahedric forms.

Obtaining tungsten with tetrahedric coordination, even when the amount of tungsten is more than 15%, is due to the method of preparation of the solid.

For example, the fact that the product of the present invention comprises more than 15% tungsten in tetrahedric form is demonstrated by the Raman spectrum of figure 1. This figure comprises the Raman spectra the process of the invention and contains 19.4% tungsten ($ZW_{0.1600}$) and a ZW_I catalyst, which is obtained by impregnation of a zirconia dioxide with a metatungstate aqueous solution and contains 19.1% tungsten. Figure 1 shows a peak at 935cm^{-1} for the $ZW_{0.1600}$ catalyst, which is attributable to tetrahedric tungsten, but there is no peak at 935cm^{-1} for the ZW_I catalyst. Instead, the ZW_I catalyst includes peaks which correspond to octahedric tungsten. Thus, the solid is affected by the method utilized.

VAUDAGNA prepares a solid by exchange in neutral or basic conditions (pH 6 or 11) by using tungstic acid dissolved in NaOH. In those conditions, it was well known by the person skilled in the art that the tungsten is under oligomers forms containing many tungsten atoms.

In basic or neutral conditions the thermodynamic of the anion exchange:



is unfavorable. For this reason, many impregnations are necessary to reach a more important tungsten amount (see, e.g., page 266, column 1), and tungsten having octahedric form is obtained.

The product of the present invention, however, is obtained by anion exchange between the zirconia and/or titanium dioxide and peroxotungstic acid in an acid medium having a pH lower than 3.

In acidic medium the trapping of the OH species displaces the equilibrium and an elevated amount of tungsten is obtained only in one step and with tetrahedric coordination even after calcination at 600°C.

Moreover, in the discussion following the results in VAUDAGNA, the problem of preponderance of species at different pH and their respective steric congestion is largely discussed. Those results would have deterred the man skilled in the art to use tungstic acid, and since 1998 the process utilized has been one that uses metatungstate.

Thus, the product by process as claimed is unobvious over VAUDAGNA, as VAUDAGNA fails to suggest using peroxotungstic solution and works in acidic medium. Indeed, VAUDAGNA does not even suggest that solid comprising more than 15% tungsten with tetrahedric coordination could be obtainable, as discussed above under reason I.

The difference between the product of VAUDAGNA and the

product of the invention is also be demonstrated by the difference in activity between a compound of the invention and a compound having tungsten with octahedric coordination.

Figure 3 of the present invention shows such a difference of activity in the DBT oxidation. For a same amount of tungsten, however, the compound of the invention is much more active than the compound having tungsten with octahedric coordination.

It is thus possible to obtain a solid having characteristics of stability, activity and exchange density which could not be obtained by the previous processes.

Therefore, VAUDAGNA fails to render obvious claims 1, 2, 6-8, 28-30, 42 and 43, and withdrawal of the rejection is respectfully requested.

Claims 3, 31-41 were rejected under 35 U.S.C. §103(a) as being unpatentable over VAUDAGNA in view of SOHN et al. Langmuir 1998 ("SOHN"). This rejection is respectfully traversed for the reasons below.

Claim 3 recites that the solid has a total acidity, measured by means of adsorption of ammonia, of between 0.1 and 0.5 mmol/g.

SOHN discloses the relationship between acidity and WO₃ content.

The position of the Official Action was that VAUDAGN discloses amounts of tungsten, e.g., 17.6-21.6wt percent, within the required range of acidity (0.1-0.5mmol/g) and that one of skill in the art would have recognized that a catalyst like those describe in the VAUDAGNA would have acidities above 0.1mmol/g.

However, there is nothing in SOHN which suggests that a catalyst with more than 15% tungsten having tetrahedric coordination could have such acidity.

Thus, claim 3 and claims 31-41 are not obvious over VAUDAGNA in view of SOHN.

Therefore, withdrawal of the rejection is respectfully requested.

Conclusion

In view of the foregoing remarks, this application is in condition for allowance at the time of the next Official Action. Allowance and passage to issue on that basis is respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future submissions, to charge any deficiency or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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